CORRELATIONS IN FY01 & FY02 PERFORMANCE STATISTICS

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RHIC Retreat – Machine Reliability Session
Wednesday 6 March, 2002

CORRELATIONS IN FY01 & FY02 STATISTICS

- Brennan stressed that I not present the same boring drivel that I present each Tuesday in the Time Meeting.
- I thought that I could use the opportunity create new ways to bore you to tears.
- What Brennan wanted was to look at the data to dispel/confirm myths like "does the program suffer on Mondays" or "do Beam Studies have an impact other than the time given to the study"?

THE CHARGE
LOOK FOR CORRELATIONS IN:

- Weather – duration of time "off" due to weather vs. time to restore "productive" operation
- Beam Studies – duration of study vs. time to restore "productive" operation
- Duration of access – duration of access (experiment/maintenance) vs. time to restore "productive" operation.
- THE ITEMS ABOVE WERE CORRELATABLE

THE CHARGE: continued

- "Time of Day" -- weekends, Monday mornings, Friday afternoons
- Context Switching
- Shift Leader
- THE ITEMS ABOVE WERE NOT READILY CORRELATABLE
- New Gear – no data / data hard to get
- Beam Loss – data forthcoming

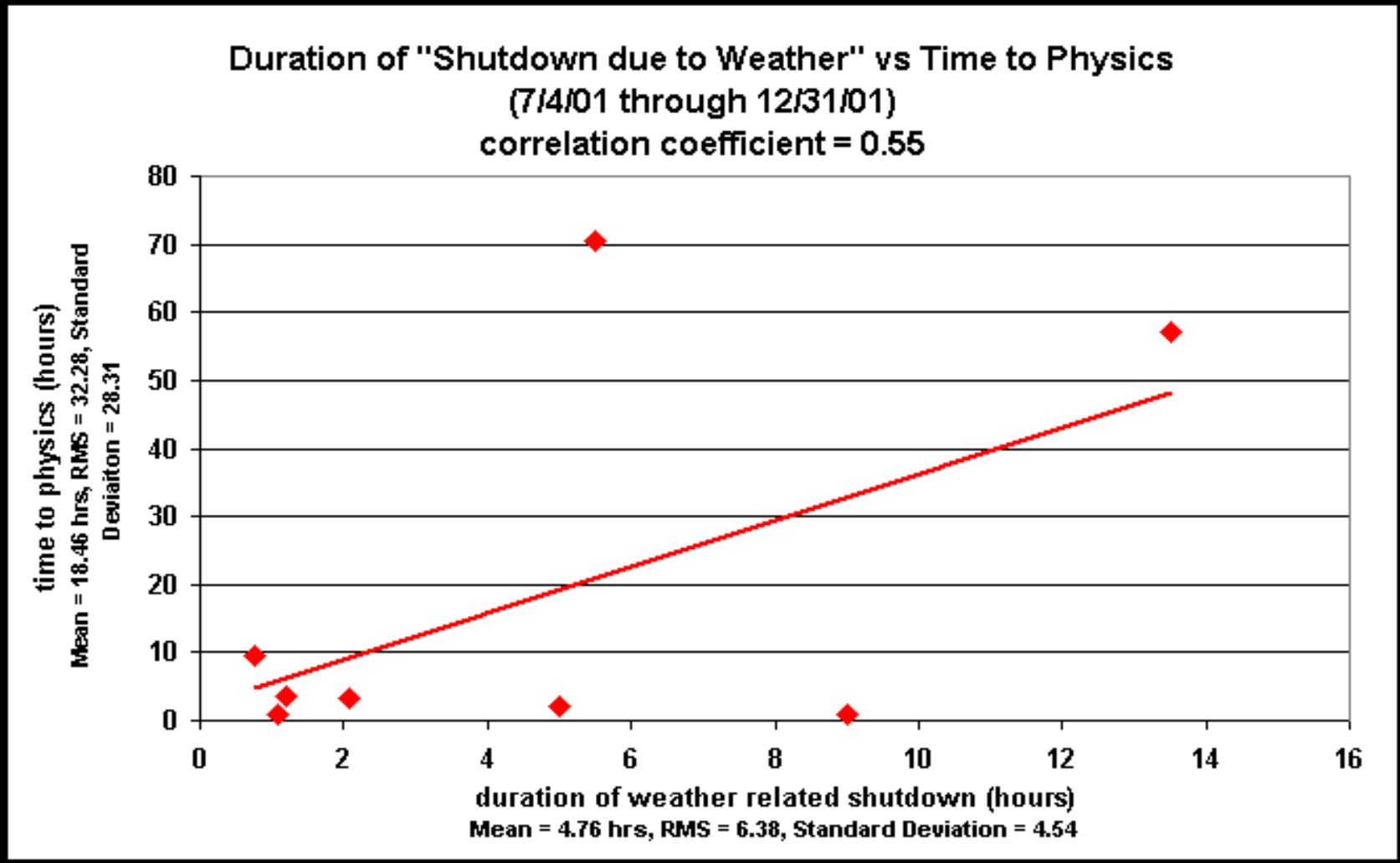
WHAT WAS DONE

- Looked at OperationsJournal data for the period 14 August 2001 through 25 January 2002.
- Did NOT look at the period before the "run clock" started, ie. earlier than 14 August.
- Compiled "Accelerator STATUS" data for the various time periods (physics, failure, setup, …).
- Correlated data where data correlation was possible.
- Made comparison histograms where data correlation was not possible.
- Did not look at failures for individual systems.

WEATHER

- Looked at
- Instances where the program was interrupted by foul weather
- And instances where the program deliberately turned off due to the expectation that foul weather was imminent.
- Found 8 events and correlated duration of time off to time to restore the program

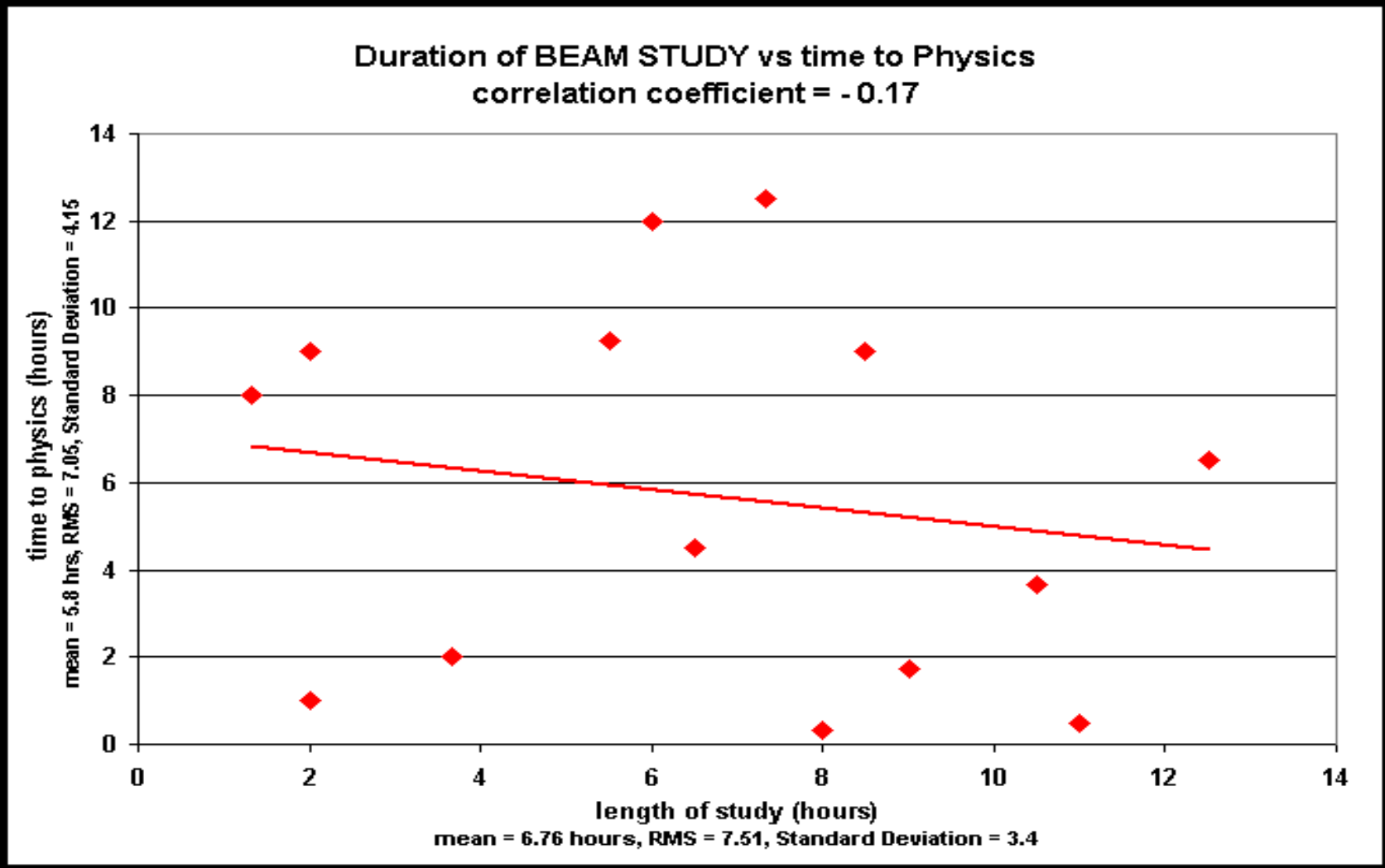
WEATHER


Duration of "Shutdown due to Weather" vs Time to Physics
(7/4/01 through 12/31/01)
correlation coefficient = 0.55
time to physics (hours)
Mean = 18.46 hrs, RMS = 32.28, Standard Deviaiton = 28.31
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
duration of weather related shutdown (hours)
Mean = 4.76 hrs, RMS = 6.38, Standard Deviation = 4.54

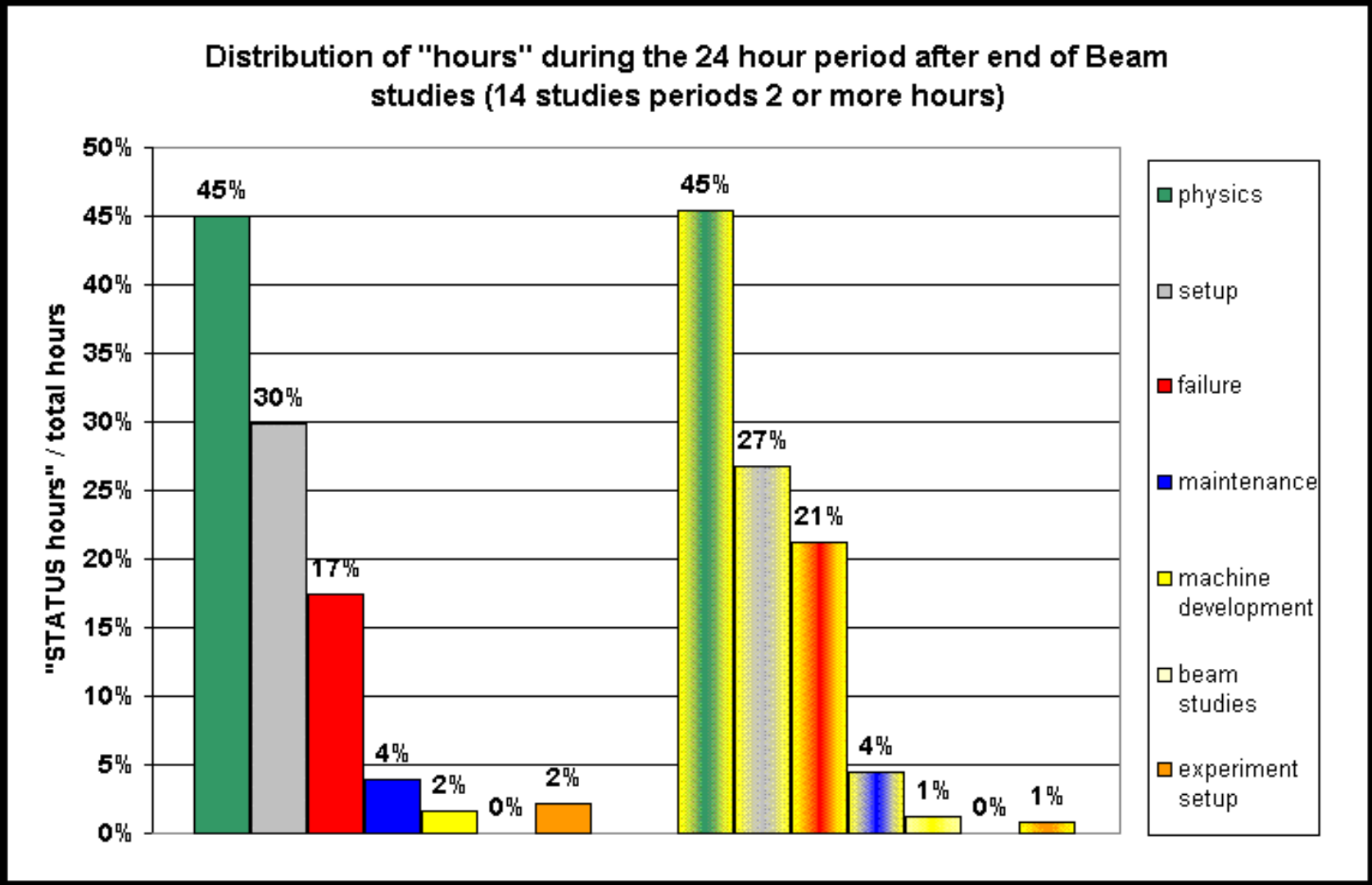
BEAM STUDY

- Looked at 14 Beam Studies periods
- Correlated duration of Study to time to restore the program
- Also looked at the 24 hour periods after studies and compared them to the distribution of hours during:
  - The entire program – Au + P^
  - The Gold run alone
  - Eight Random 24 hour periods

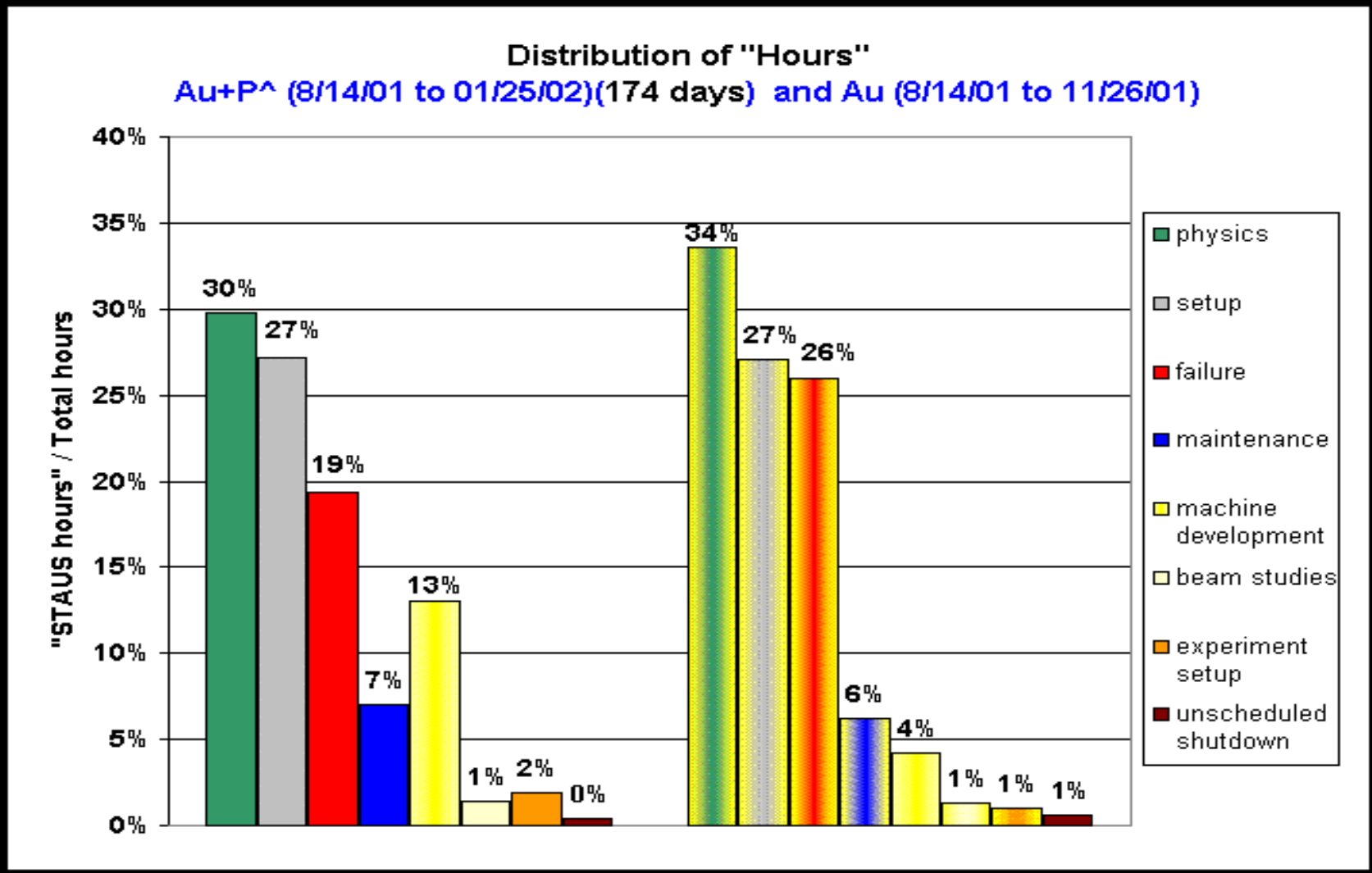
BEAM STUDY correlation



BEAM STUDY histogram

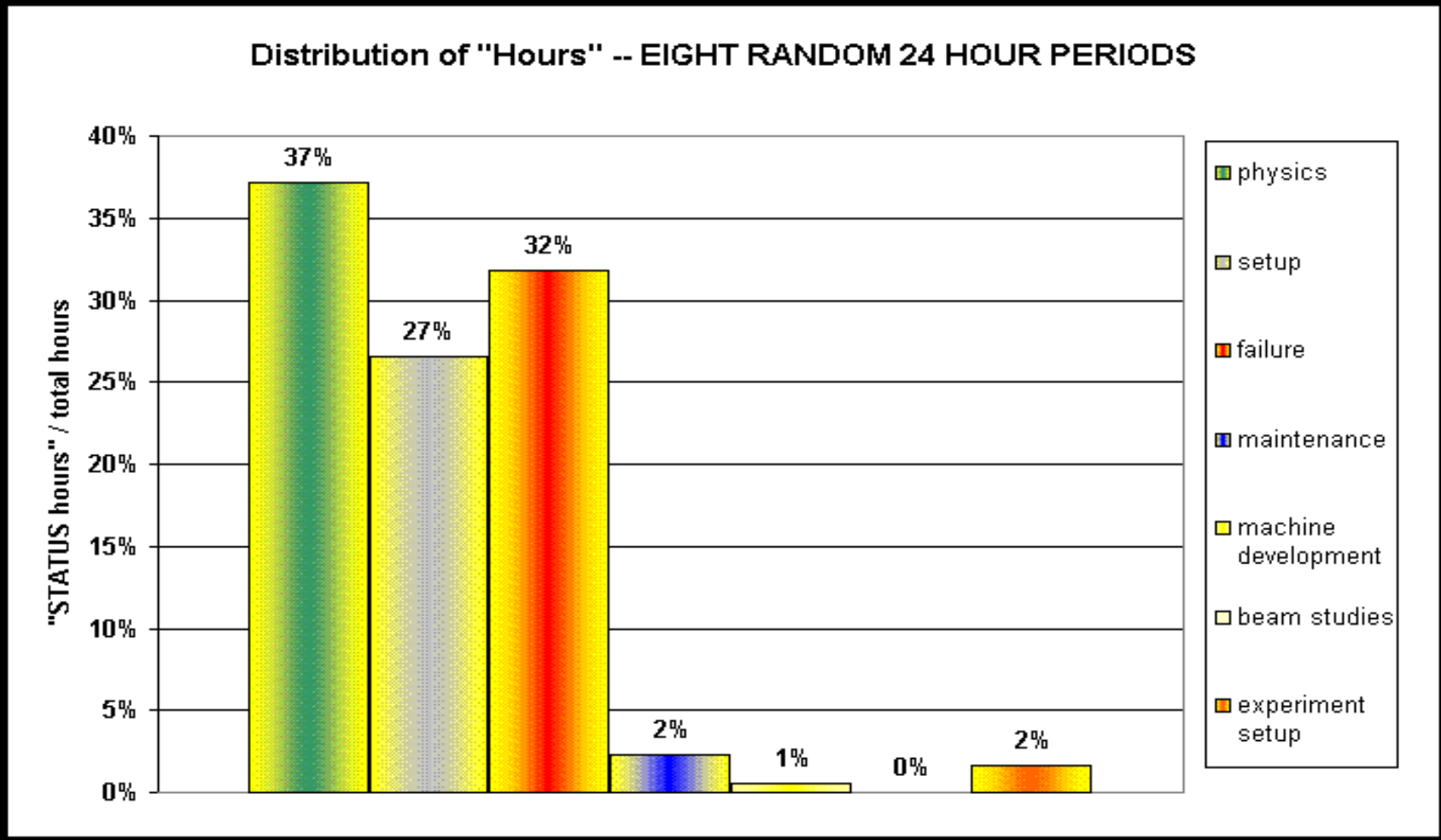


DISTRIBUTION OF "HOURS"



DISTRIBUTION OF HOURS

EIGHT RANDOM 24 hr PERIODS



BEAM STUDY comparison table

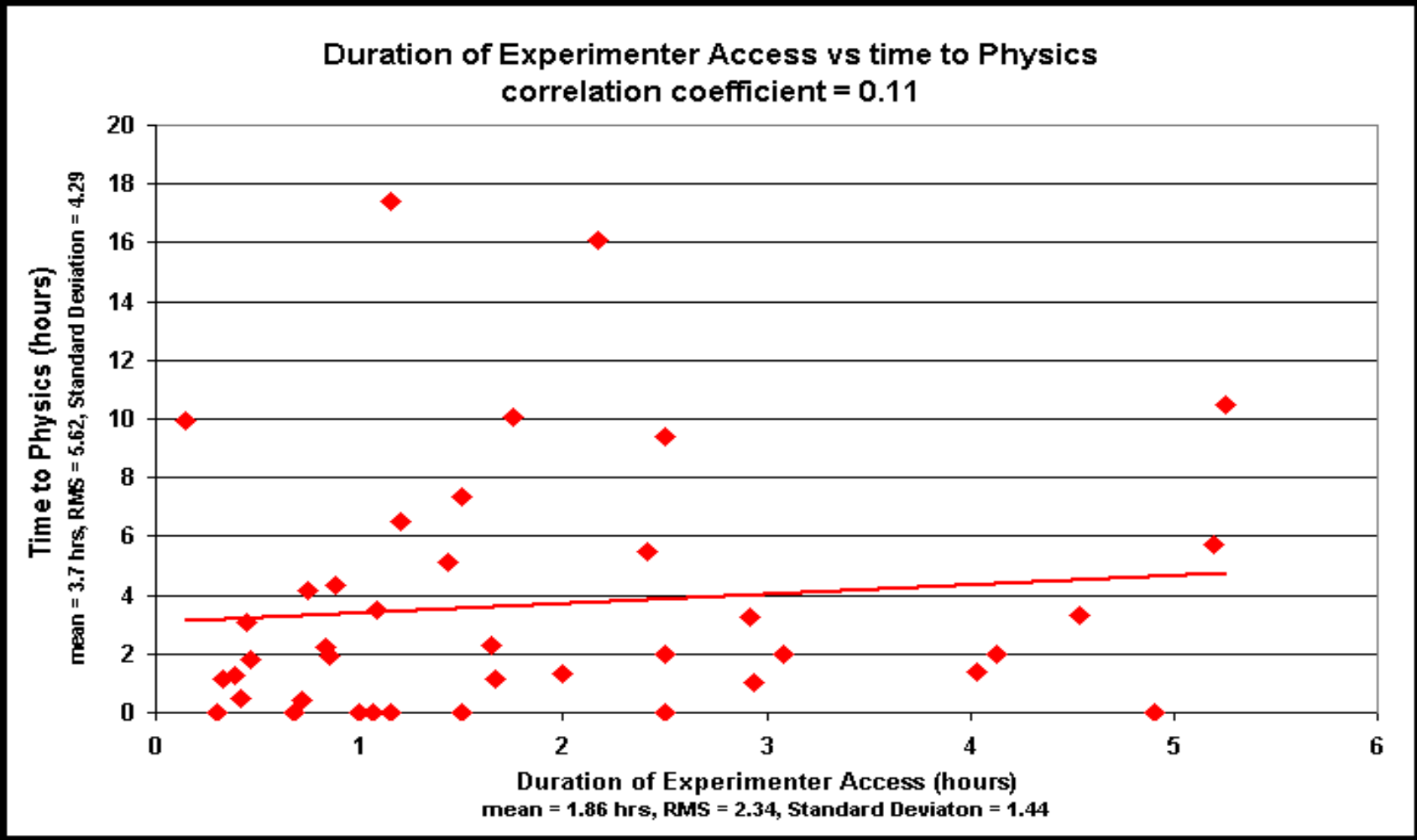
COMPARISON OF HOURS						
	physics	setup	failure	maintenance	Machine Development	Experiment Setup
Total Run (Au + P^)	30%	27%	19%	7%	13%	2%
Au run	34%	27%	26%	6%	4%	1%
Eight Random 24 hr. Periods -- Au run	37%	27%	32%	2%	1%	2%
BEAM STUDIES						
Beam Study -- Difference from Total Run	15%	3%	-2%	-3%	-11%	0%
Beam Study -- Difference from Au Run	11%	0%	-5%	-3%	-12%	-1%
Beam Study -- Difference from Random	12%	0%	-11%	2%	0%	-1%

DURATION OF ACCESSS

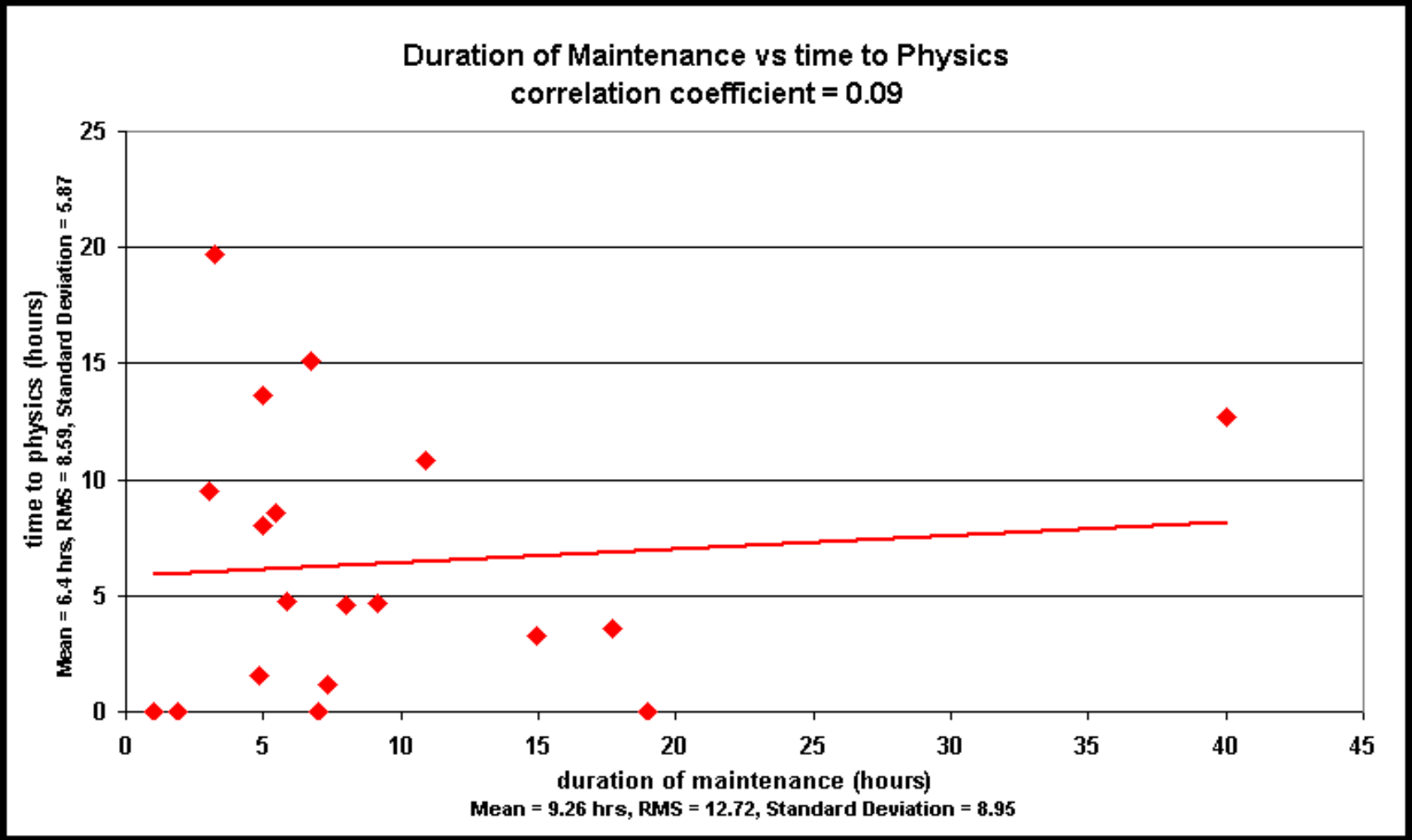
- Looked at
- Maintenance periods and Experimenter access periods
- Correlated duration of Maintenance to time to restore the program
- Correlated duration of experimenter access to time to restore the program

DURATION OF ACCESS

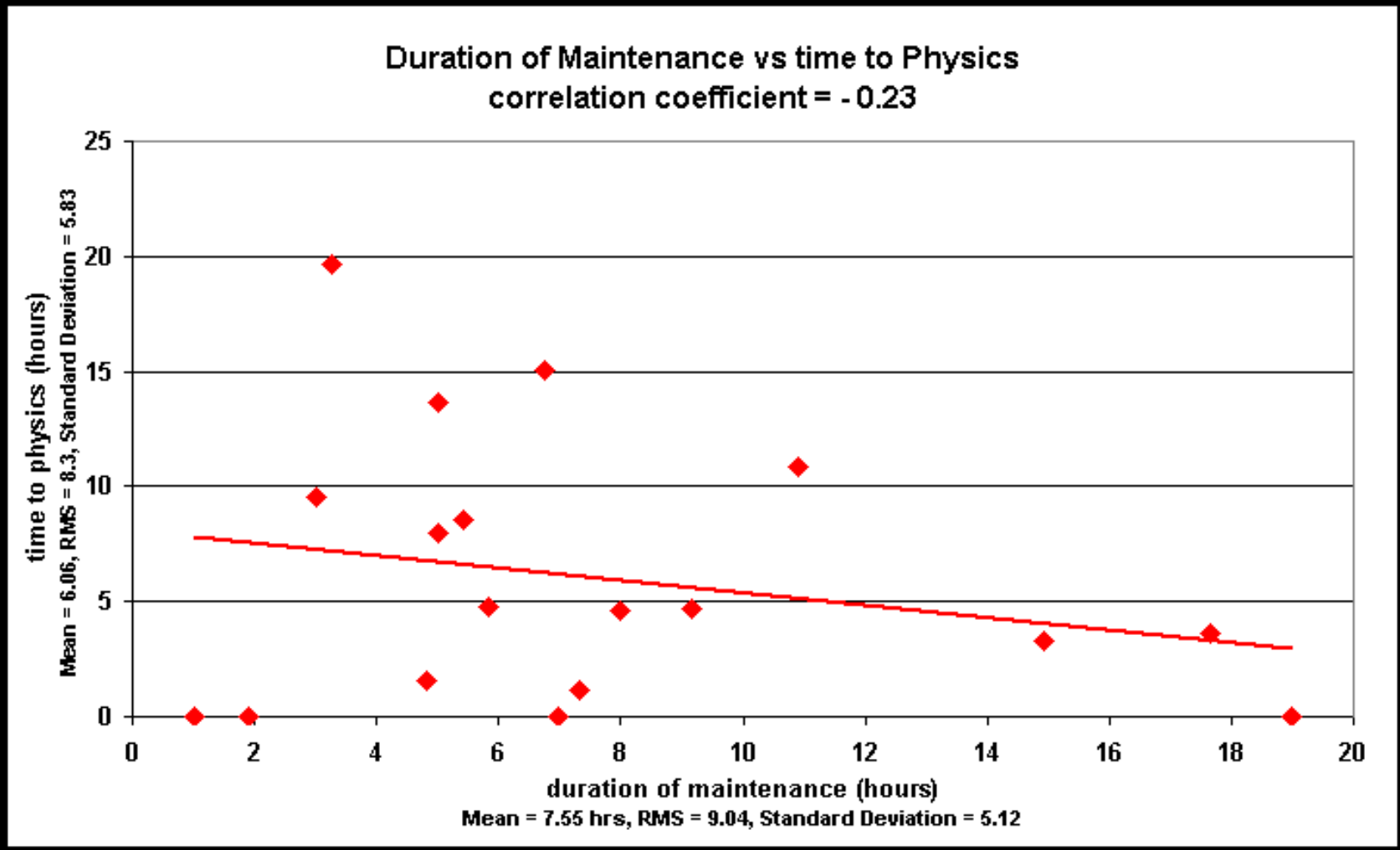
EXPERIMENTER ACCESS



DURATION OF ACCESS
MAINTENANCE



MAINTENANCE
ANOTHER VIEW

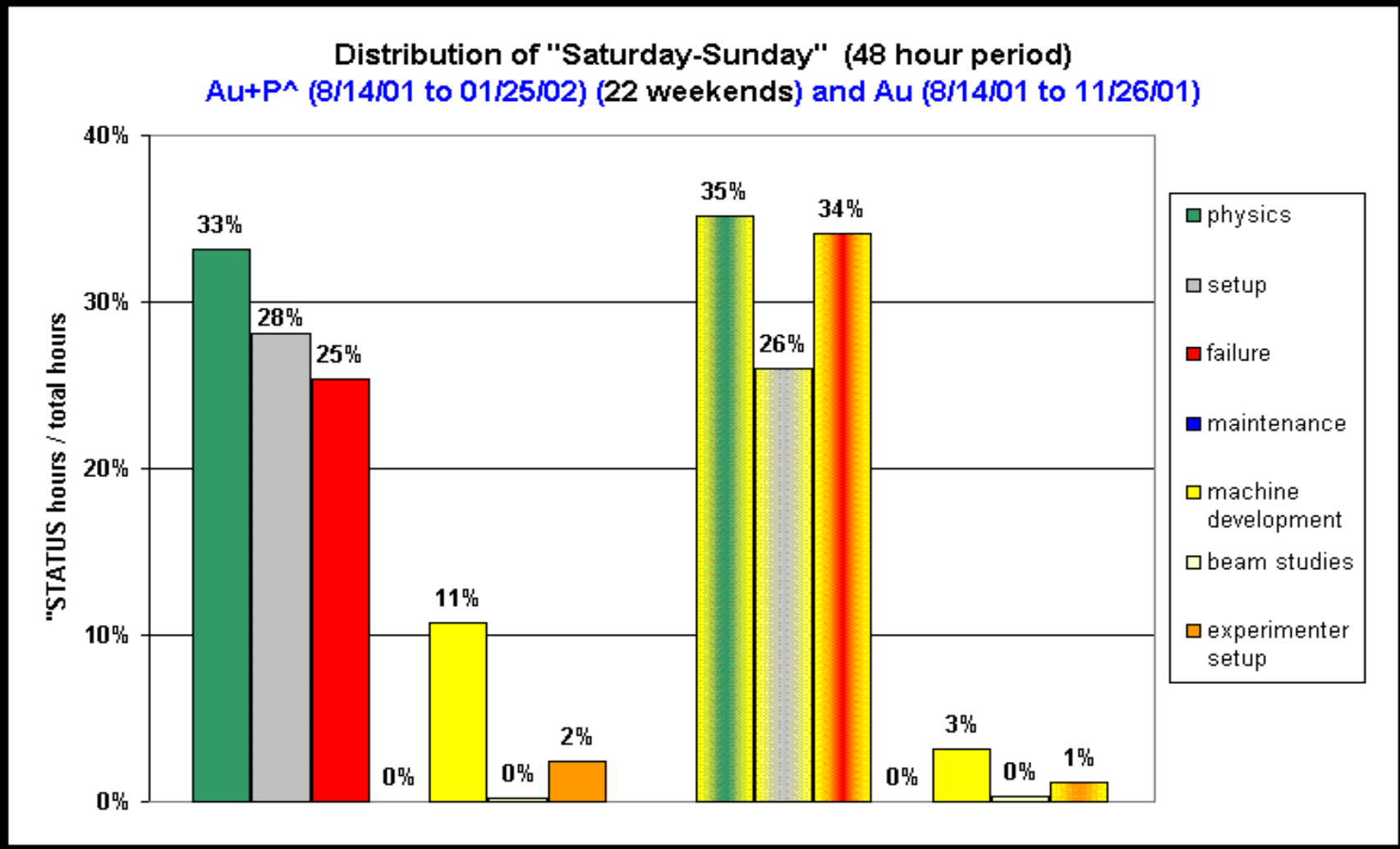


TIME OF DAY

- Looked at
- Weekends (22)– Saturday/Sunday – 48 hrs
- Monday (24) day shift (0800-1600)
- Friday (22) afternoon-evening (1600-2400)

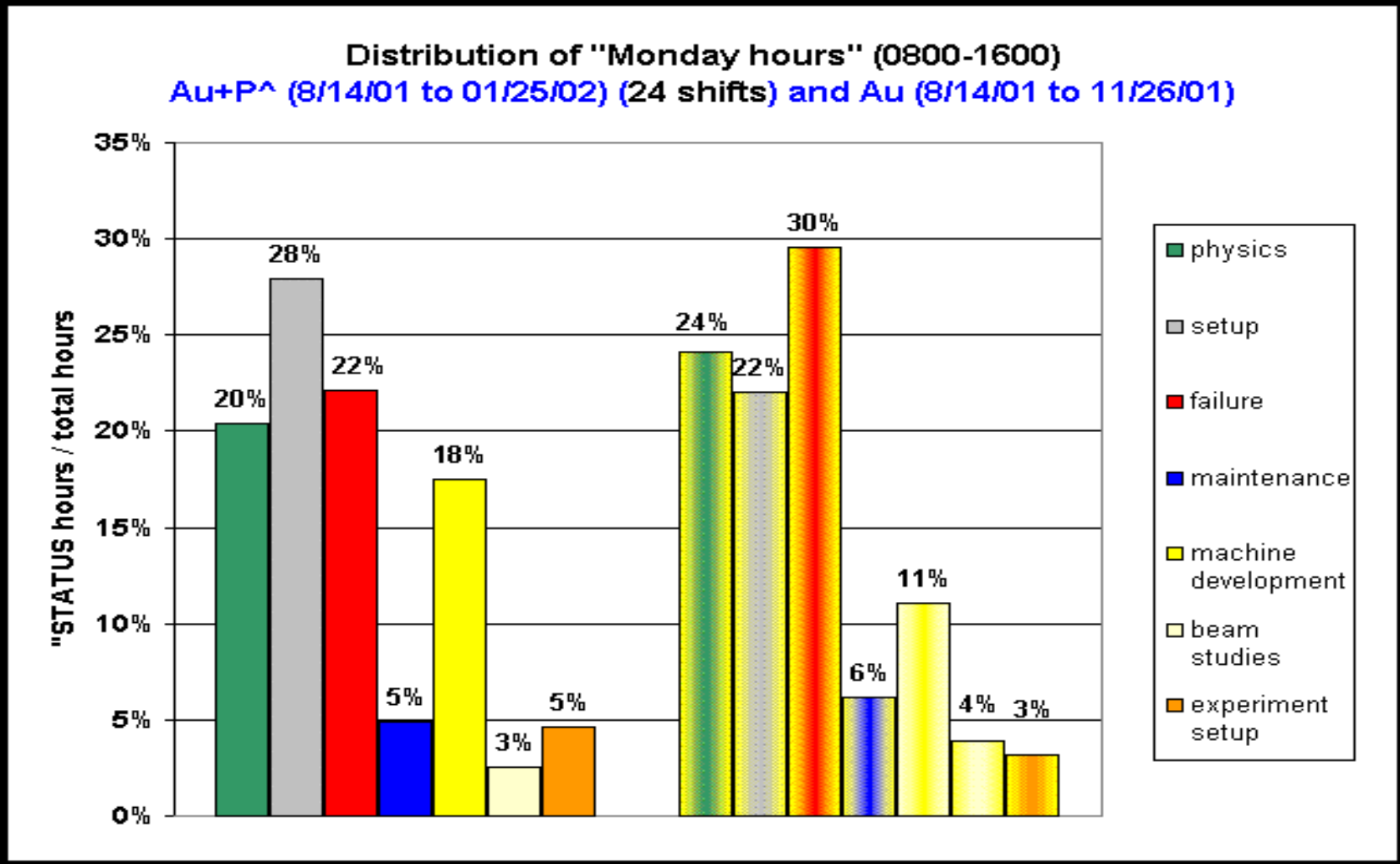
TIME OF DAY

Saturday-Sunday(48 hours)



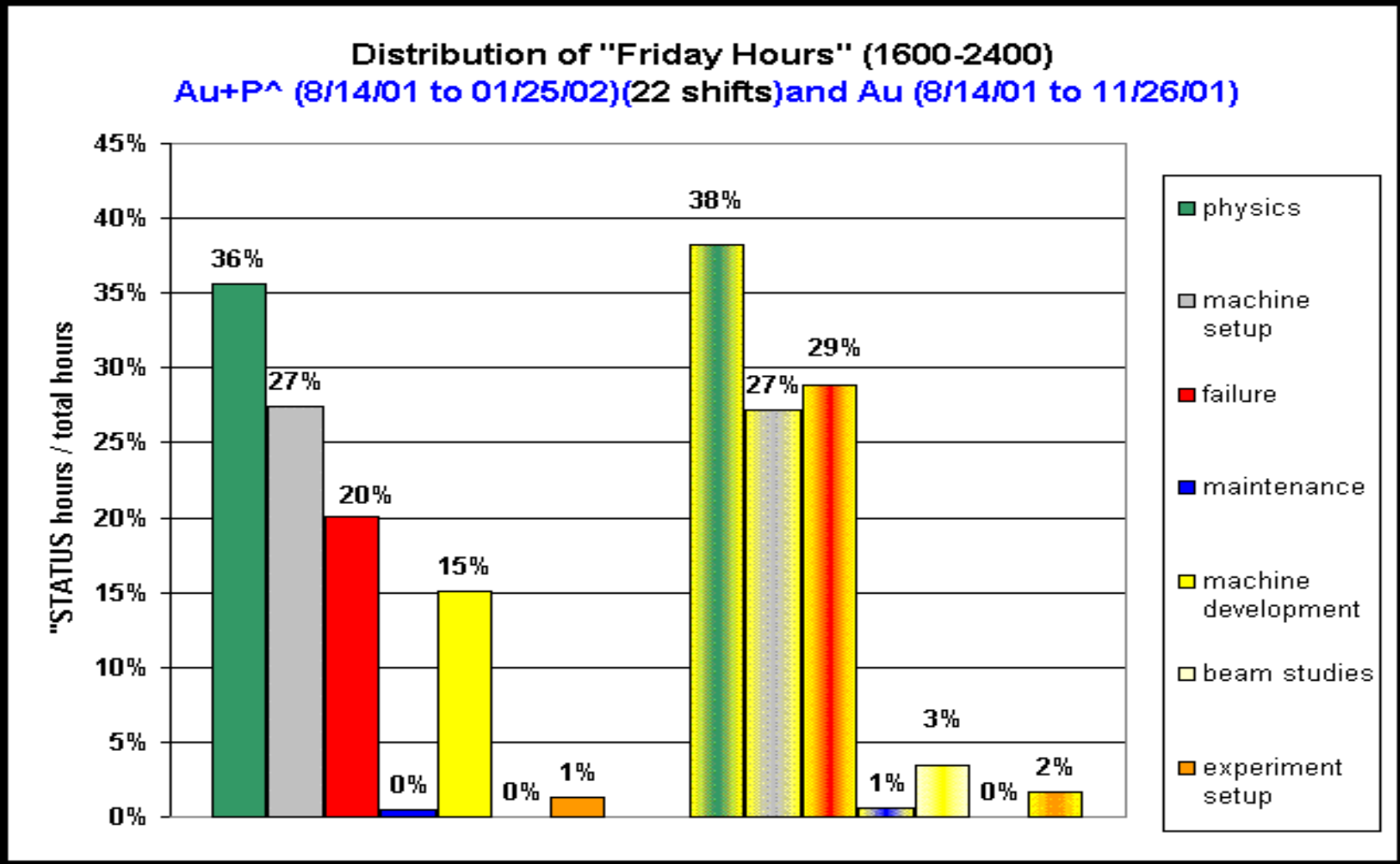
TIME OF DAY

Monday 0800-1600



TIME OF DAY

Friday 1600-2400



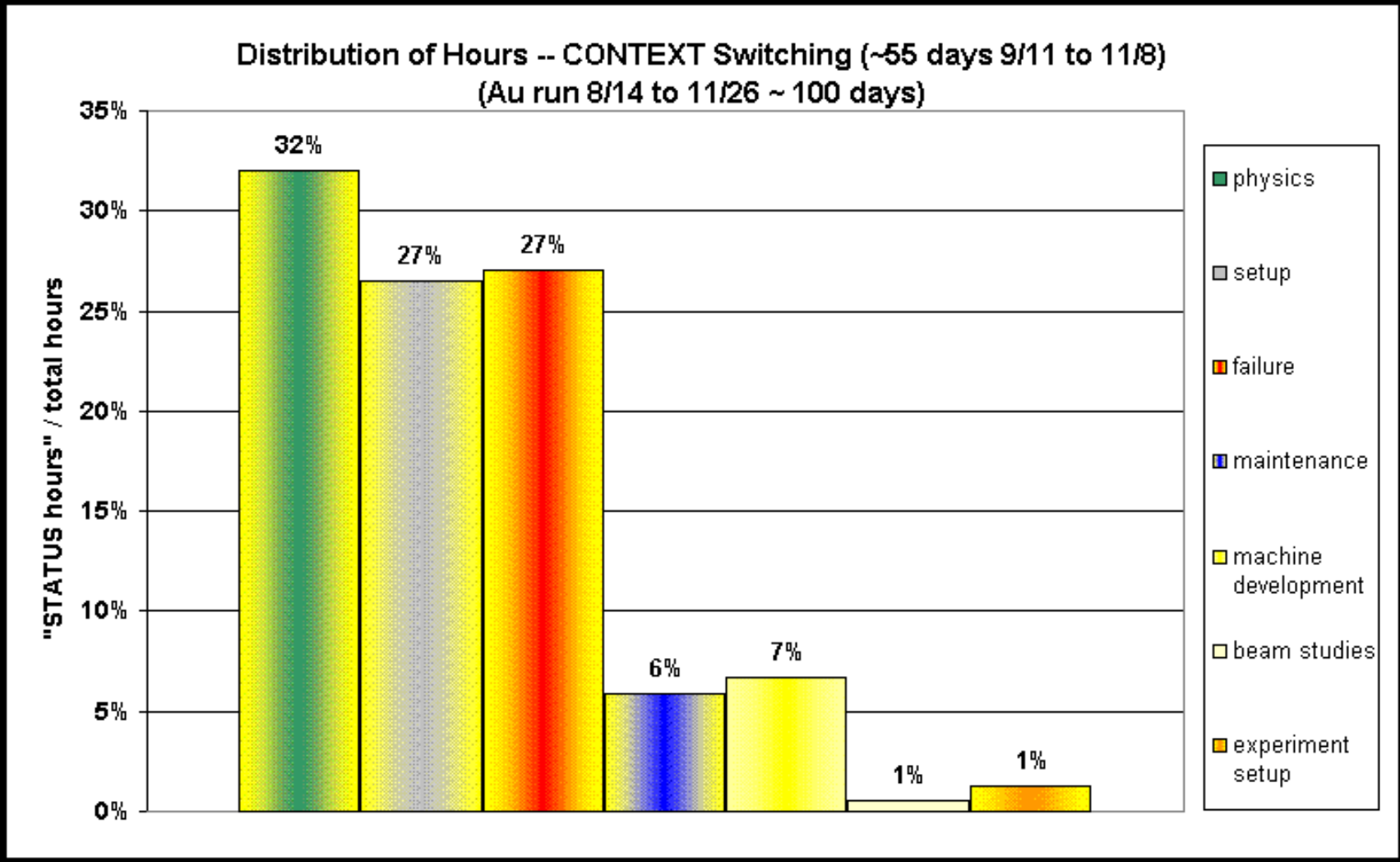
TIME OF DAY comparison table

COMPARISON OF HOURS							
	physics	setup	failure	maintenance	machine development	beam studies	experiment setup
Total Run (Au + P^)	30%	27%	19%	7%	13%	1%	2%
Au run	34%	27%	26%	6%	4%	1%	1%
Eight Random 24 hr. Periods -- Au run	37%	27%	32%	2%	1%	0%	2%
TIME OF DAY							
Sat/Sun -- Difference from Total Run	3%	1%	6%	-7%	-2%	-1%	0%
Sat/Sun -- Difference from Au Run	1%	-1%	8%	-6%	-1%	-1%	0%
Sat/Sun -- Difference from Random	-2%	-1%	2%	-2%	2%	0%	-1%
Monday -- Difference from Total Run	-10%	1%	3%	-2%	5%	2%	3%
Monday -- Difference from Au Run	-10%	-5%	4%	0%	7%	3%	2%
Monday -- Difference from Random	-13%	-5%	-2%	4%	10%	4%	1%
Friday -- Difference from Total Run	6%	0%	1%	-7%	2%	-1%	-1%
Friday -- Difference from Au Run	4%	0%	3%	-5%	-1%	-1%	-1%
Friday -- Difference from Random	1%	0%	-3%	-1%	2%	0%	0%

CONTEXT SWITCHING

- Looked at the period 9/11 to 11/8 (55 days) during which we ran the proton SEB program during RHIC stores
- Compared the distribution of hours of the RHIC Au program for that period to
  - The entire run – Au + P^ (164 days)
  - The Au program (~100 days)
  - Eight Random 24 hour periods during Au (8 days)

CONTEXT SWITCHING



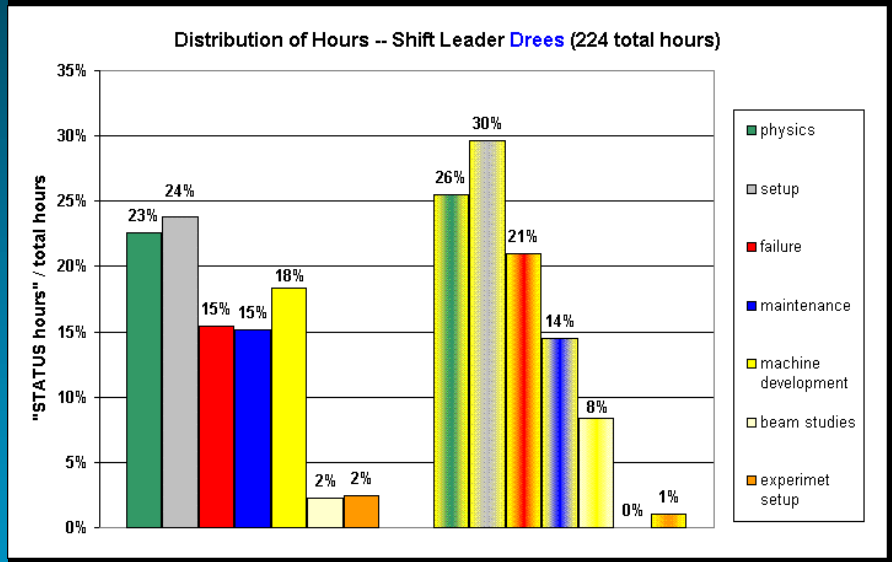
CONTEXT SWITCHING

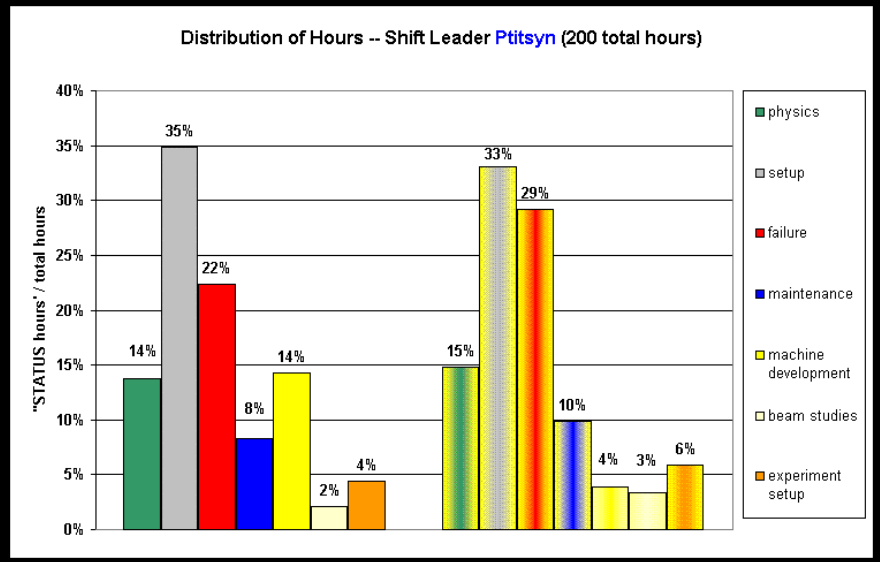
COMPARISON OF HOURS							
	physics	setup	failure	maintenance	machine development	beam studies	experiment setup
Total Run (Au + P^)	30%	27%	19%	7%	13%	1%	2%
Au run	34%	27%	26%	6%	4%	1%	1%
Eight Random 24 hr. Periods -- Au run	37%	27%	32%	2%	1%	0%	2%
CONTEXT SWITCHING							
Difference from Total Run	2%	0%	8%	-1%	-6%	0%	-1%
Difference from Au Run	-2%	0%	1%	0%	3%	0%	0%
Difference from Random	-5%	0%	-5%	4%	6%	1%	-1%

SHIFT LEADER

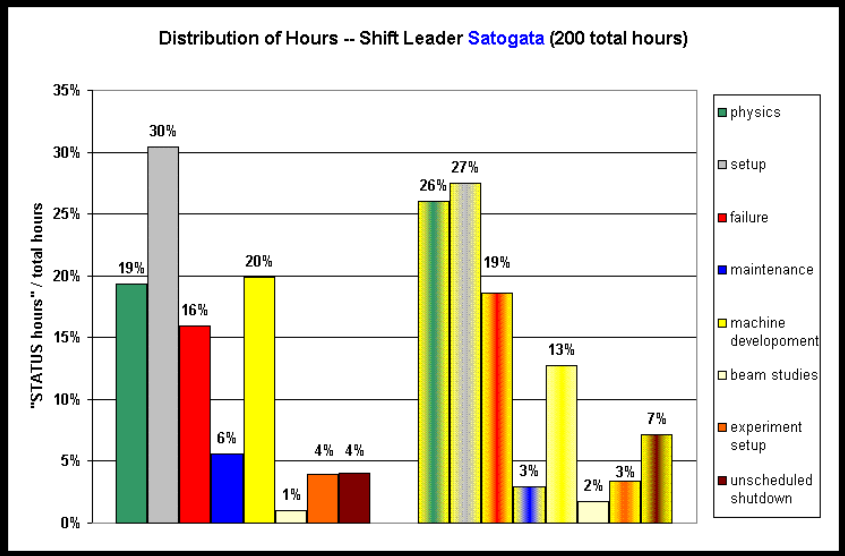
- Looked at
- SEVEN shift leaders
- Times chosen according to shift schedule on the web.
- Chosen because they served as shift leaders for both Au and P^ operation
- Compared the “status hours” for each leader vs. “status hours” for
  - The entire run Au + P^
  - The Au run
  - Eight Random 24 hour periods

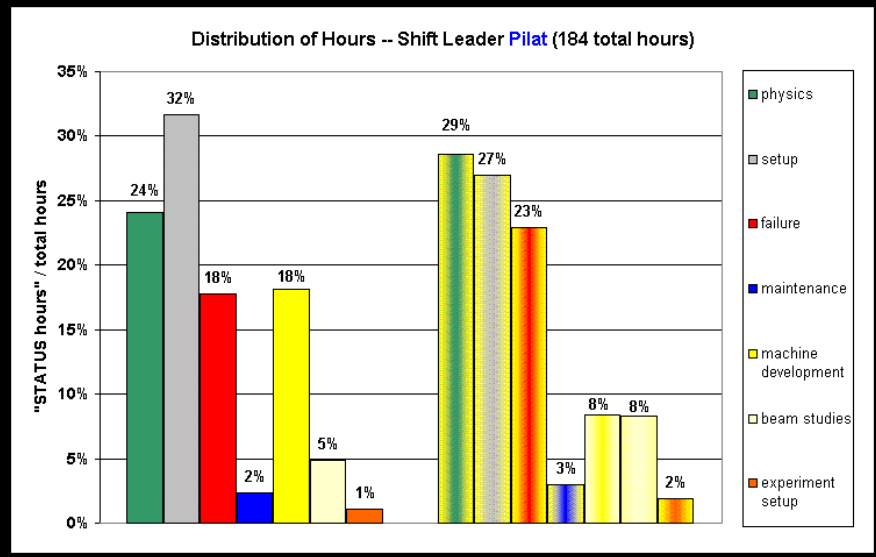
SHIFT LEADER



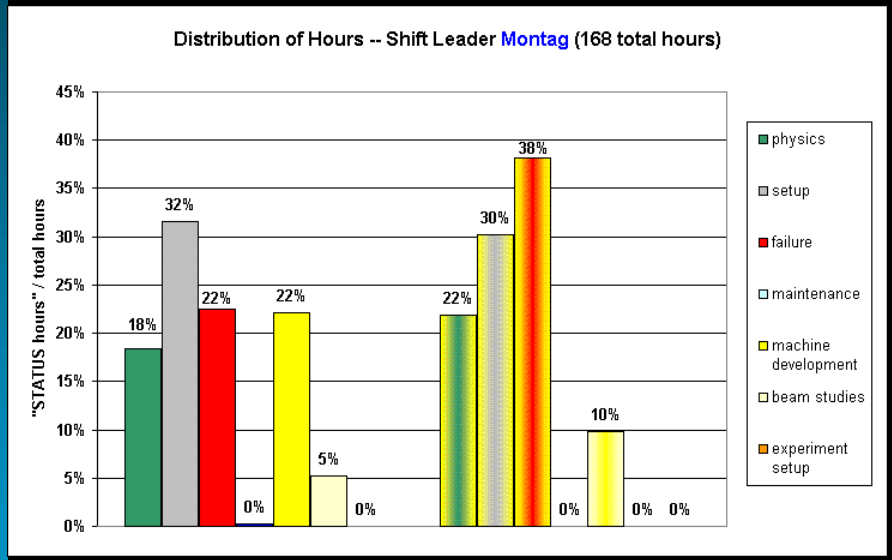


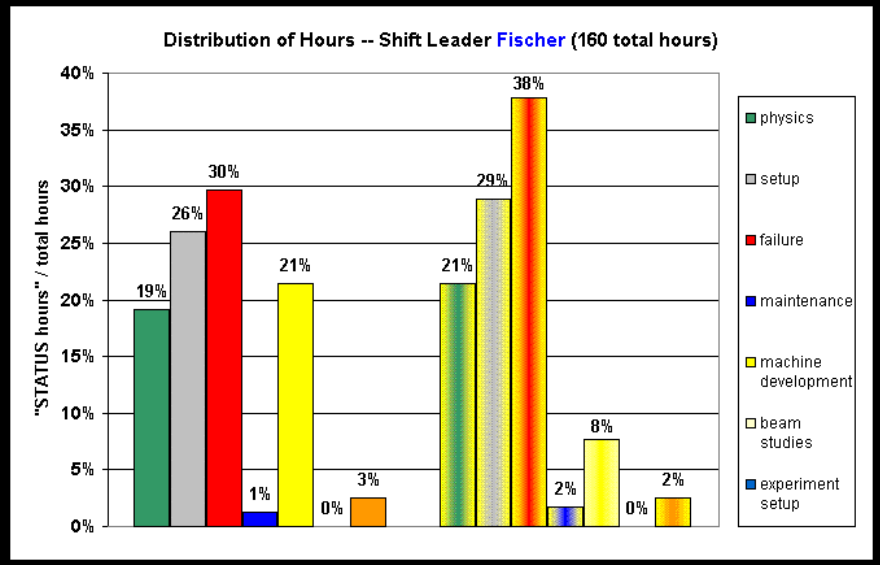
SHIFT LEADER





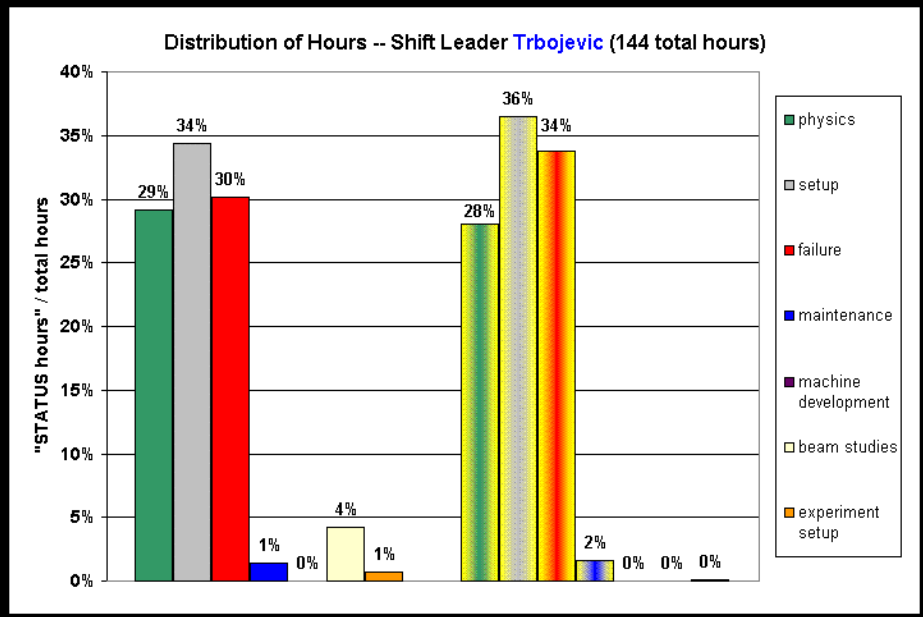
SHIFT LEADER





SHIFT LEADER

- Shift leaders sorted by hours served.
- Did not look at the long period since rhic went cold and the run clock started ~ 1 May to 14 August



SHIFT LEADER

comparison table

COMPARISON OF HOURS							
	physics	setup	failure	maintenance	machine development	beam studies	experiment setup
Total Run (Au + P^)	30%	27%	19%	7%	13%	1%	2%
Au run	34%	27%	26%	6%	4%	1%	1%
Eight Random 24 hr. Periods -- Au run	37%	27%	32%	2%	1%	0%	2%
SHIFT LEADER							
Drees -- Difference from Total Run	-7%	-3%	-4%	8%	5%	1%	0%
Drees-- Difference from Au Run	-8%	3%	-5%	8%	4%	-1%	0%
Drees -- Difference from Random	-11%	3%	-11%	12%	7%	8%	-1%
Ptitsyn -- Difference from Total Run	-16%	8%	3%	1%	1%	1%	2%
Ptitsyn -- Difference from Au Run	-19%	8%	-4%	2%	10%	1%	3%
Ptitsyn -- Difference from Random	-22%	6%	-3%	8%	3%	3%	4%
Satogata -- Difference from Total Run	-11%	3%	-3%	-1%	7%	0%	2%
Satogata -- Difference from Au Run	-8%	0%	-7%	-3%	9%	1%	2%
Satogata -- Difference from Random	-11%	0%	-13%	1%	12%	2%	1%

SHIFT LEADER

comparison table

COMPARISON OF HOURS							
	physics	setup	failure	maintenance	machine development	beam studies	experiment setup
Total Run (Au + P^)	30%	27%	19%	7%	13%	1%	2%
Au run	34%	27%	26%	6%	4%	1%	1%
Eight Random 24 hr. Periods -- Au run	37%	27%	32%	2%	1%	0%	2%
SHIFT LEADER							
Pilat -- Difference from Total Run	-6%	5%	-1%	-5%	5%	4%	-1%
Pilat-- Difference from Au Run	-5%	0%	-3%	-3%	4%	7%	1%
Pilat -- Difference from Random	-8%	0%	-9%	1%	7%	8%	0%
Montag -- Difference from Total Run	-12%	5%	3%	-7%	9%	4%	-2%
Montag -- Difference from Au Run	-12%	3%	12%	-6%	6%	-1%	-1%
Montag -- Difference from Random	-15%	3%	6%	-2%	9%	0%	-2%
Fischer -- Difference from Total Run	-11%	-1%	11%	-6%	8%	-1%	1%
Fischer -- Difference from Au Run	-13%	2%	12%	0%	7%	0%	0%
Fischer -- Difference from Random	-16%	2%	6%	0%	7%	0%	0%
Trbojevic -- Difference from Total Run	-1%	7%	11%	-6%	-13%	3%	-1%
Trbojevic -- Difference from Au Run	-6%	9%	8%	-4%	-4%	-1%	-2%
Trbojevic -- Difference from Random	-9%	9%	2%	0%	1%	0%	-2%

CONCLUSIONS

- Weather
  - No surprise – reasonable correlation between time off and time to restore program
- Beam Study
  - Weak inverse correlation between duration of study and time to restore program
  - Comparison with Au+P^, Au, Random 24 hr. periods shows 24 hours periods after studies contain more physics and less failures.
  - Fulvia – thanks for the case of Bass Ale

CONCLUSIONS

- Access – Experimenter
  - Weak correlation between duration of experiment access and time to restore physics
- Access – Maintenance
  - Inverse correlation between duration of maintenance and time to restore physics

CONCLUSIONS

- Time of Day
  - Saturday – Sunday more failures than "normal"
  - Monday days – Much less physics and more machine development
  - Friday afternoons – less maintenance and slightly more physics compared to Au and Au + P^ run

CONCLUSIONS

- Context Switching
  - The histogram of hours during context switching so closely resembles the “norm” (Au + P^ and Au runs) that one might conclude that Context Switching had no effect

CONCLUSIONS

- Shift Leader
  - Physics benefited when shift leaders were not present
  - Drees – more maintenance on her shifts
  - Satogata – more Machine Development on his shifts
  - Pilat – more Beam Studies on her shifts
  - Fewer Failures during Satogata, Drees, Pilat shifts

CONCLUSIONS

- Brennan opened my eyes
- Next step is to take steps to make correlations and comparisons easier in the future

FINAL OBSERVATION

- Have you noticed that there is a strong correlation between the number of hours in a day (24) and the number of cans in a case of beer (24).